A 14.5 pW, 31 ppm/C Resistor-Less 5 pA Current Reference Employing A Self-Regulated Push-Pull Voltage Reference Generator

Tech ID: 25934 / UC Case 2016-299-0

TECHNOLOGY DESCRIPTION

Disclosed here is a novel gate-leakage-based supply and temperature-stabilized current reference generator that can output currents as low as 5 pA with minimal power overhead. The output reference current is generated by driving a set of gate-leakage transistors designed to have opposing temperature coefficients with a stabilized voltage reference. Low-power operation is achieved by generating the voltage reference via a novel two-stage, 4T push-pull structure that can operate at a low supply voltage, and driving this reference to the gate-leakage transistors via a low-voltage self-biased amplifier. Designed in a 65 nm CMOS process, the proposed current reference generator is simulated to consume 14.5 pW at a 0.5 V supply voltage. Due to the push-pull structure and complementary gate-leakage transistors, the design achieves a temperature stability of 31 ppm/C from 0C to 100C, and a line sensitivity of 0.94%/V, thereby enabling an ultra-low-power, area-efficient, and temperature- and supply stabilized current reference solution at pico Amp-levels.

APPLICATIONS

Ultra-low-power and low-voltage current references are an integral part of advanced wireless sensing networks, IoT, environmental monitoring and implantable medical devices. As an indispensable component for most of such applications, current reference circuits occupy a large portion of the sleep mode power budget of near-zero-power sensing nodes because they often operate with 100% duty cycle to bias watchdog timers and wake-up analog elements.

ADVANTAGES

The breakthroughs presented in the current technology will greatly reduce the power requirements for this key component.

STATE OF DEVELOPMENT

This work is patent pending with worldwide rights available. Commercial partners are encouraged to contact invent@ucsd.edu for more information.

RELATED MATERIALS

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Published Application	20190101947	04/04/2019	2016-299
Patent Cooperation Treaty	Published Application	2017201353	11/23/2017	2016-299

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OTHER INFORMATION

KEYWORDS

engineering, physical science,

wireless, telecomm, hardware

CATEGORIZED AS

- Engineering
  - Engineering

RELATED CASES

2016-299-0